Missouri Department of Natural Resources

Biological Assessment Report

Crane Creek
Stone County, Missouri

2013 - 2014

Prepared for:
Missouri Department of Natural Resources
Division of Environmental Quality
Water Protection Program
Water Pollution Control Branch

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Table of Contents

Section Page

1.0 Introduction 1
1.1 Study Area/Justification 1
1.2 Objectives 2
1.3 Tasks 2
1.4 Null Hypotheses 2
2.0 Methods 2
2.1 Study Timing 2
2.2 Station Descriptions 3
2.2.1 Bioassessment Sampling Station 3
2.2.2 Reference Habitat Assessment Station 4
2.3 Ecological Classification 4
2.3.1 Ecological Drainage Unit 4
2.3.2 Aquatic Ecological Systems 5
2.4 Land Use/Land Cover 6
2.5 Stream Habitat Assessment 7
2.6 Biological Assessment 7
2.6.1 Macroinvertebrate Collection and Analysis 7
2.7 Physicochemical Data Collection and Analysis 8
2.7.1 *In situ* Water Quality Measurements 8
2.7.2 Water Chemistry 8
2.7.3 Fine Sediment Character 9
2.8 Data Analysis 9
3.0 Results 9
3.1 Land Use/Land Cover 9
3.2 Stream Habitat Assessment 10
3.3 Macroinvertebrate Biological Assessment 11
3.3.1 Semi-quantitative Macroinvertebrate Stream Bioassessment Project Procedure 11
3.3.2 Analysis of Hypothetical Biological Criteria Data Sets 13
3.3.3 Percent EPTT and Dominant Macroinvertebrate Families 14
3.3.4 Dominant Macroinvertebrate Taxa 15
3.3.5 Biotic Index 16
3.3.6 Functional Feeding Groups 17
3.4 Physicochemical Data 18
3.4.1 Surface Water 18
3.4.2 Fine Sediment 18
4.0 Discussion 19
5.0 Conclusions 21
6.0 Recommendations 21
7.0 References Cited 23

Tables

Page

Table 1 Percent Land Use/Land Cover 10
Table 2 Category Habitat Scores and Total Habitat Scores from Stream Habitat Assessments for Crane Creek and the Spring Creek Biological Reference Stream Reach 11
Table 3 Fall Cold Water Biological Criteria for Perennial/Wadeable Streams in the Combined EDUs, Macroinvertebrate Stream Condition Index (MSCI) Scores, and Support Categories at Crane Creek 12
Table 4 Spring Cold Water Biological Criteria for Perennial/Wadeable Streams in the Combined EDUs, Macroinvertebrate Stream Condition Index (MSCI) Scores, and Support Categories at Crane Creek 12
Table 5 Thresholds to Attain an Optimal Metric Score in Hypothetical Data Sets and the Number of Samples per Set 13
Table 6 Metric and MSCI Scores When Using Hypothetical Biological Reference Data Sets 14
Table 7 Percent EPT and dominant Macroinvertebrate Families in Crane Creek 15
Table 8 Percent Macroinvertebrate Taxa Ranked by Dominance in the Biological Reference Streams in the Combined EDUs 16
Table 9 Physicochemical Parameters in Crane Creek Surface Water 19
Table 10 Total Metals Character in Crane Creek Fine Sediment 19

Figures

Figure 1 Map of Crane Creek and Sampling Stations 3
Figure 2 Map of Crane Creek Watershed, EDUs, and Biological Reference Locations 5
Figure 3 Map of Crane Creek Land Use/Land Cover 7
Figure 4 MSCI Scores from All Crane Creek Samples 13
Figure 5 Percent of Taxa by Biotic Index Threshold in Fall Samples 17
Figure 6 Percent of Taxa by Biotic Index Threshold in Spring Samples 17
Figure 7 Percent of Functional Feeding Groups (FFGs) 18

Attachments

Appendix A Crane Creek Macroinvertebrate Taxa Lists

1.0 Introduction

At the request of the Missouri Department of Natural Resources (**MDNR**) Water Protection Program (**WPP**), the Environmental Services Program (**ESP**) Water Quality Monitoring Section (**WQMS**) conducted a biological assessment of Crane Creek. It is located in the Ozark/White Ecological Drainage Unit (**EDU**), originating in southwestern Lawrence County. Crane Creek is designated as a Class P stream (Water Body Identification [**WBID**] 2382) in the Missouri Water Quality Standards (MDNR 2014a) for 13.2 miles starting northwest of Crane in Stone County to downstream of its confluence with Spring Creek south of Hurley. From there Crane Creek is designated as a Class P warm water fishery (WBID 2381) in the Missouri Water Quality Standards (MDNR 2014a) for 5.9 miles until it reaches its confluence with the James River. This study focuses on the cold water portion of Crane Creek (WBID 2382). In addition to cold water fishery protection, designated uses for this portion of Crane Creek include protection of warm water aquatic life, human health/fish consumption, livestock and wildlife watering, secondary contact recreation, and whole body contact recreation – category A (MDNR 2014a).

Crane, Missouri, is rich with railroad history (Hemphill 1963). The railroad arrived in 1904, and Crane soon became a railway terminal town complete with a roundhouse. Although the railroad industry in Crane is not as extensive as it once was, remnants of the terminal infrastructure still exist to the west of the town. The railroad is still active, paralleling and occasionally crossing Crane Creek well up into its headwaters.

The upper 8 miles of Crane Creek is managed by the Missouri Department of Conservation as a Blue Ribbon trout fishery. Crane Creek is one of the few streams in Missouri that sustains a wild population of rainbow trout (*Oncorhynchus mykiss*), with the last known stocking occurring in the late teens or possibly 1920 (Auckley 2010). According to Missouri Department of Conservation's most recent Prospects Report for Crane Creek, 340 trout per mile were observed at the upper Wire Road Conservation Area, and 421 trout per mile were observed at the lower Wire Road Conservation Area.

According to the Missouri Geological Survey's Inventory of Mines, Occurrences, and Prospects (**IMOP**) database, which is based on the United States Bureau of Mines' Mineral Industry Location System database for Missouri, there are also multiple abandoned lead and zinc mines located in headwater reaches of the Crane Creek watershed. When viewing the IMOP Geographical Information System (**GIS**) coverage, the concentration of these mines in Crane Creek headwaters near Aurora and Marionville, Missouri, is quite notable.

1.1 Study Area/Justification

Crane Creek is on the 2012 303(d) list of impaired waters and the proposed 2014 303(d) list of impaired waters for low aquatic macroinvertebrate bioassessment scores/unknown pollutants. Biological assessments were conducted on Crane Creek in 1997 in order to test biological criteria. The results of these unpublished data showed three of the four samples to be partially supporting of the protection of warm water aquatic life use designation as specified in the Missouri Water Quality Standards (MDNR 2014a).

1.2 Objectives

1) Characterize land cover data for the Crane Creek watershed.
2) Determine the stream habitat quality of Crane Creek.
3) Assess the biological (macroinvertebrate) integrity and water quality of Crane Creek.
4) Characterize contaminant metals in the fine sediment of Crane Creek.

1.3 Tasks

1) Analyze Crane Creek and biological reference stream land cover data to ensure watershed comparability.
2) Conduct a stream habitat assessment at Crane Creek to ensure comparability with biological references.
3) Conduct a biological assessment of Crane Creek.
4) Collect water quality field measurements, surface water samples, and fine sediment samples at Crane Creek.

1.4 Null Hypotheses

1) Land cover characteristics in the Crane Creek watershed will not differ from the land cover characteristics of the Ozark/White Ecological Drainage Unit (**EDU**), Ozark/Neosho EDU, or riffle/pool, cold water biological reference streams in those EDUs.
2) The stream habitat assessment scores in Crane Creek will not differ from Spring Creek, the riffle/pool, cold water biological criteria reference stream in the Ozark/White EDU.
3) The macroinvertebrate community in Crane Creek will not differ from the riffle/pool, cold water community for the combined Ozark/White and Ozark/Neosho EDU, the Ozark/White EDU, Ozark/Neosho EDU, or a biological reference stream with the same Aquatic Ecological System (**AES**) type in a neighboring EDU.
4) Physicochemical water quality in the surface water of Crane Creek will meet the Water Quality Standards of Missouri (MDNR 2014a).
5) Total metals in the fine sediment of Crane Creek will not exceed consensus-based guidelines.

2.0 Methods

Mike Irwin of the Biological Assessment Unit, WQMS, ESP, Division of Environmental Quality (**DEQ)**, MDNR, conducted this study. Bioassessment, physicochemical, and fine sediment field work for the fall 2013 and spring 2014 sampling seasons was conducted by Mike Irwin, Brandy Bergthold, and Carl Wakefield of the Biological Assessment Unit. Habitat assessments were conducted by Mike Irwin and Carl Wakefield. Fine sediment field work was completed by Mike Irwin.

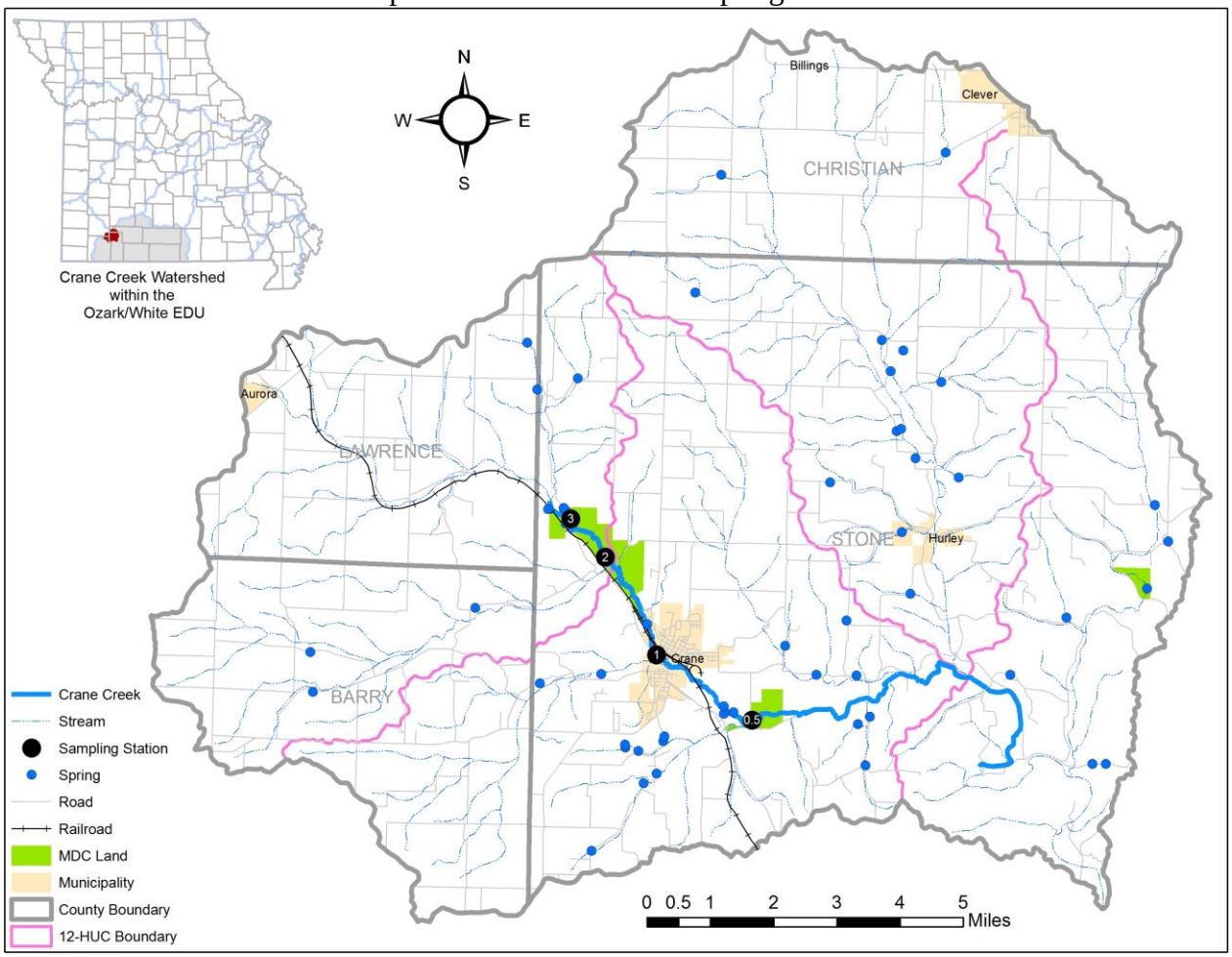
2.1 Study Timing

Macroinvertebrate and discrete water quality samples were collected once during the fall 2013 and spring 2014 sampling seasons. Habitat assessments for the Crane Creek stations and the Spring Creek biological reference station were completed during the fall 2013 season. Fine sediment samples were collected in July 2014.

2.2 Station Descriptions

The study area and sampling locations for the Crane Creek bioassessment study are shown in Figure 1. Stations #0.5, #1, and #3 were surveyed for bioassessment, water quality, and fine sediment sampling in 2013 and 2014. Stations #1 and #2 were surveyed for bioassessment and water quality in 1997. Station #2 was completely dry in fall 2013. For this reason, a third sampling station was established upstream in a reach known to have steady flow.

Figure 1
Map of Crane Creek and Sampling Stations



2.2.1 Bioassessment Sampling Stations

Crane Creek #0.5 – Stone County: Legal description was NW¼ NE¼ Sec. 10, T. 25 N., R. 24 W. Geographic coordinates were UTM zone 15, 0451101 Easting, 4082661 Northing. The station was located downstream of Grisham Ford Road in the lower Wire Road Conservation Area.

Crane Creek #1 – Stone County: Legal description was NW¼ NW¼ Sec. 4, T. 25 N., R. 24 W. Geographic coordinates were UTM zone 15, 0448675 Easting, 4084316 Northing. The station was located upstream of the Myrna Lewers Parkway dead-end in Crane City Park.

Crane Creek #2 – Stone County: Legal description was SW¼ Sec. 29, T. 26 N., R. 24 W. Geographic coordinates were UTM zone 15, 0446487 Easting, 4087782 Northing. The station was located upstream of Old Wire Road in the upper Wire Road Conservation Area. This station was not sampled in 2013 or 2014. It is provided for informational purposes.

Crane Creek #3 – Stone County: Legal description was NE¼ Sec. 30, T. 26 N., R. 24 W. Geographic coordinates were UTM zone 15, 0446487 Easting, 4087782 Northing. The station was located downstream of Roundhouse Road in the upper Wire Road Conservation Area.

2.2.2 Reference Habitat Assessment Station

Spring Creek – Douglas County: Legal description was W ½ Sec. 26, T. 25 N., R. 11 W. Geographic coordinates were UTM zone 15, 05776057 Easting, 4075335 Northing. The station was located downstream of County Road 14-292.

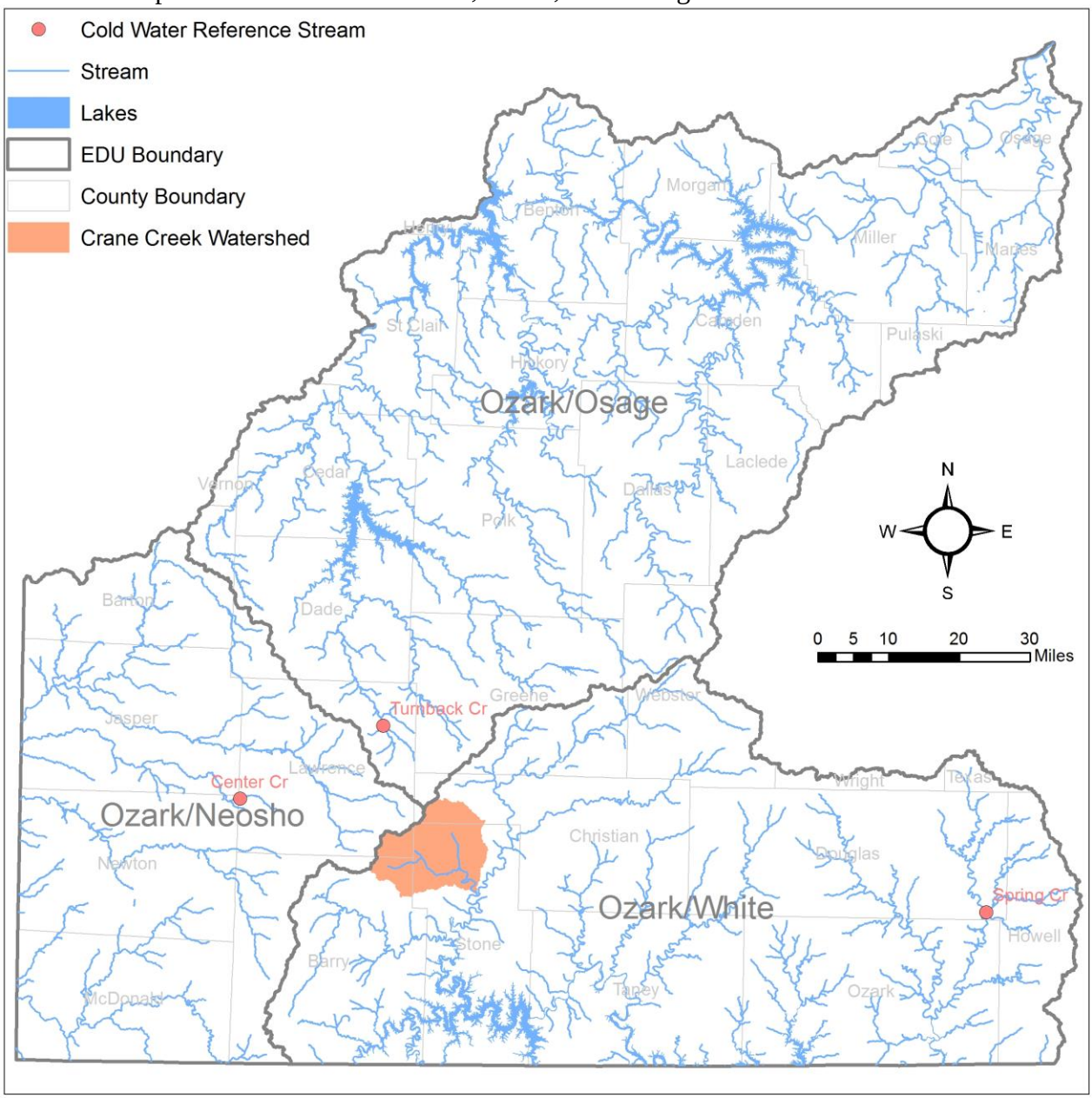
2.3 Ecological Classification

The Crane Creek watershed is located in the Ozark Highlands ecoregion. The aquatic ecological classification developed by the Missouri Resource Assessment Partnership (**MoRAP**) is a classification system that divides the aquatic resources of Missouri into distinct regions. It has seven levels of classification starting at large regions and then dividing them into smaller sub-regions (Sowa & Diamond 2006). The following are the seven levels of classification in hierarchical order: zone, subzone, region, aquatic subregions, EDU, AES, and Valley Segment Types (**VST**). The levels of classification are based on biology, zoogeography, taxonomic composition, geology, soils, and groundwater connection. Some levels of the hierarchical system use geology and soils to classify, and other levels use biology and taxonomic composition of aquatic communities. EDU and AES are the two levels of the classification system that will be assessed in detail for this study.

2.3.1 Ecological Drainage Unit

The EDU is level five of the classification hierarchy. It is based on geographical variation of the taxonomic composition of the level four subregions. An EDU is a region in which aquatic biological communities and habitat conditions can be expected to be similar. In regards to Missouri's biological criteria, criteria must be derived from a minimum of two streams (MDNR 2002). Since only one cold water reference stream exists in the Ozark/White EDU, cold water reference criteria are derived from a combination of the Ozark/White EDU and the Ozark/Neosho EDU, the most ecologically similar EDU (MDNR 2002). The Ozark/Neosho EDU also contains only one cold water biological reference stream. Locations of combined EDUs and both biological reference streams are shown in Figure 2.

Figure 2
Map of Crane Creek Watershed, EDUs, and Biological Reference Locations



2.3.2 Aquatic Ecological Systems

The AES is level six of the classification hierarchy. It classifies aquatic systems into types based on geology, soils, landform, and groundwater influence. Crane Creek is located in the Finley Creek Aquatic Ecological Systems type. According to Sowa and Diamond (2006):

> This AES-Type is located in the Ozarks of southwest Missouri and roughly follows the south-eastern edge of the [United States Forest Service's] Springfield Plain Ecological

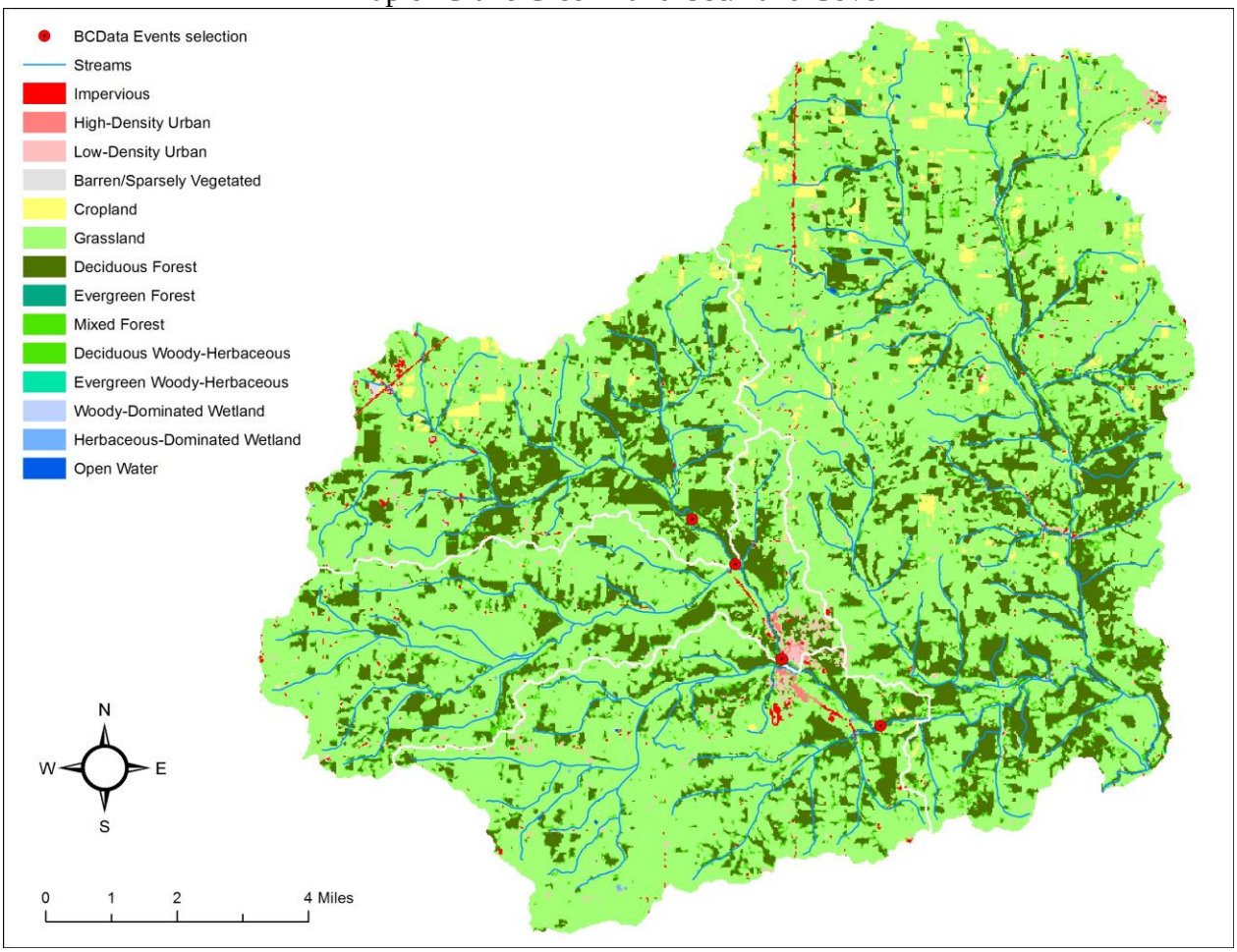
> Subsection. Local relief ranges from nearly zero to slightly over 60 meters. The geology here consists of Mississippian period cherty limestones with significant karst features including sinkholes, caves and springs. Some of the highest densities of sinkholes in the state of Missouri can be found within this AES-Type. Minor amounts of dolomite and sandstone are also present. The deep soils were formed in weathered cherty limestone and often have loess as the surface material. Surface soil textures consist of cherty and silt loam soils with moderate to slow infiltration rates. Stream discharge is highest at the end of winter and early spring and subsequently diminishes throughout summer and into fall. Heavy rain events can produce flash flooding. Streams carry bed loads consisting of sand and chert gravel, but carry very little suspended sediment. Some of the highest densities of losing streams in the state are found in this Type, especially in the James River and Indian Creek drainages. Springs are common and can be quite large contributing significantly to stream base flows. Groundwater is abundant and of good quality. Coldwater is an important ecological feature of this Type. There are 489 headwater/creek springs and one main stem spring scattered throughout the Missouri portion of this Type. This AES-Type contains one spring over 10 cfs. The median spring count is 29.5. The combined headwater and creek mean stream gradient is 13.2 meters per kilometer. The historic vegetation consisted primarily of prairie, but timber was located along the stream valleys.

The AES types for the cold water biological reference streams in the Ozark/White EDU and Ozark/Neosho EDUs are different than the AES type for Crane Creek. To provide additional analysis or interpretation of results, comparison was also made with Turnback Creek, a cold water biological reference stream in the Ozark/Osage EDU. The Ozark/Osage EDU adjoins the Crane Creek watershed, and the Turnback Creek biological reference reach is closer in proximity to Crane Creek than either of the cold water biological reference reaches designated by the Missouri biological criteria. The cold water biological reference reach for Turnback Creek is also shown in Figure 2.

2.4 Land Use/Land Cover

Land use conditions were summarized from land cover GIS files. Percent land cover data were derived from Thematic Mapper satellite data collected between 2000 and 2004 and interpreted by the MoRAP (Sowa et al. 2004). Figure 3 is a map of the land cover within the Crane Creek watershed.

Figure 3
Map of Crane Creek Land Use/Land Cover



2.5 Stream Habitat Assessment

A standardized assessment procedure was followed as described for riffle/pool habitat in the Stream Habitat Assessment Project Procedure (**SHAPP**) (MDNR 2010d). Habitat assessments were conducted in fall 2013 on Crane Creek stations and one station on Spring Creek, the cold water biological reference stream for the Ozark/White EDU.

2.6 Biological Assessment

Biological assessments consist of macroinvertebrate collection and physicochemical sampling for two sample periods.

2.6.1 Macroinvertebrate Collection and Analysis

A standardized macroinvertebrate sample collection and analysis procedure was followed as described in the Semi-quantitative Macroinvertebrate Stream Bioassessment Project Procedure (**SMSBPP**) (MDNR 2012a) for riffle/pool streams. Samples were collected from the following

standard riffle/pool habitats: coarse substrate (**CS**); depositional substrate in non-flowing water (**NF**); and root mat (**RM**).

A standardized sample analysis procedure was followed as described in the SMSBPP. The following four metrics were used: 1) Taxa Richness (**TR**); 2) total number of taxa in the orders Ephemeroptera, Plecoptera, Trichoptera Taxa (**EPTT**); 3) Biotic Index (**BI**); and 4) Shannon Diversity Index (**SDI**). These metrics were scored and combined to form the Macroinvertebrate Stream Condition Index (**MSCI**). MSCI scores of 16-20 qualify as fully supporting, 10-14 are partially supporting, and 4-8 are considered non-supporting of the warm water aquatic life beneficial use designation as specified in the Missouri Water Quality Standards (MDNR 2014a). In the case of Crane Creek, the macroinvertebrate community associated with a beneficial use designation of cold water fishery is also taken into consideration.

The second analysis was an evaluation of macroinvertebrate community composition by percent composition of dominant macroinvertebrate groups. The third analysis was an evaluation of the predominance of taxa in varying BI ranges at the Crane Creek stations and collectively for biological reference streams within the combined Ozark/White and Ozark/Neosho EDUs. Taxa were divided into the following five BI tolerance value ranges in order of most sensitive to most tolerant: 0 to <2.5, 2.5 to 4.9, 5.0 to 7.4, 7.4 to 8.9, and >8.9. Percentages of total taxa were then calculated for each of these five sensitivity/tolerance ranges. The fourth analysis was an analysis of Functional Feeding Groups (**FFG**s). The FFGs for all of the Crane Creek samples were compared to the FFGs for the combined Ozark/White and Ozark/Neosho EDUs.

2.7 Physicochemical Data Collection and Analysis

2.7.1 *In situ* Water Quality Measurements

During each sampling period, *in situ* water quality measurements were collected at Crane Creek. Field measurements included turbidity (**NTU**), pH (**su**), water temperature (**°C**), specific conductance (**µS/cm**), and dissolved oxygen (**mg/L**). For these measurements, the following Standard Operating Procedures (**SOP**s) were used: turbidity, MDNR-ESP-012 (MDNR 2010a); pH, MDNR-ESP-100 (MDNR 2012b); water temperature, MDNR-ESP-101 (MDNR 2010b); specific conductance, MDNR-ESP-102 (MDNR 2010c); and dissolved oxygen, MDNR-ESP-103 (MDNR 2012c).

2.7.2 Water Chemistry

Grab samples of stream water were collected and returned for analyses to ESP's Chemical Analysis Section (**CAS**). Water quality samples from Crane Creek were analyzed for non-filterable residue (**NFR**), sulfate (**SO_4**), chloride (**Cl**), total phosphorus (**TP**), ammonia-N (**NH_3-N**), nitrate+nitrite-N (**NO_3+NO_2-N**), total nitrogen (**TN**), and hardness. Procedures outlined in *Field Sheet and Chain-of-Custody Record*, SOP MDNR-ESP-002 (MDNR 2014b) and *Required/Recommended Containers, Volumes, Preservatives, Holding Times, and Special Sampling Considerations*, SOP MDNR-ESP-001 (MDNR 2011) were followed when collecting water quality samples. NFR, Cl, TP, NH_3-N, NO_3+NO_2-N, TN, and hardness are reported in mg/L. Stream velocity was measured at each station during the survey period using a Marsh-McBirney Flo-Mate™ Model 2000. Discharge was calculated per the methods in the SOP

MDNR-ESP-113, *Flow Measurement in Open Channels* (MDNR 2013). Discharge is reported as cubic feet per second (**cfs**).

2.7.3 Fine Sediment Character

Due to the presence of abandoned lead and zinc mines in the upper portions of the Crane Creek watershed, fine sediment was characterized at each sampling station for Cd, Pb, and Zn. Sediment for all Crane Creek stations was sampled in July 2014. Each sample was a composite of one 2-ounce jar collected downstream of three separate riffles, yielding an approximate 6-ounce total composite. These composites were then dried and analyzed by CAS for total cadmium, lead, and zinc. Procedures outlined in *Field Sheet and Chain-of-Custody Record*, SOP MDNR-ESP-002 (MDNR 2014b), and *Required/Recommended Containers, Volumes, Preservatives, Holding Times, and Special Sampling Considerations*, SOP MDNR-ESP-001 (MDNR 2011), were followed when collecting fine sediment samples. Results are reported in mg/kg.

2.8 Data Analysis

The physicochemical data were examined by variable to determine whether Crane Creek had violations of the Missouri Water Quality Standards (MDNR 2014a). Values for total metals in fine sediment were measured against the consensus-based Probable Effects Concentrations (**PEC**) and the Sum Probable Effect Quotient for cadmium, lead, and zinc (**$\Sigma PEQ_{Cd,Pb,Zn}$**) (MacDonald et al. 2000). The PEC is the level of a contaminant above which harmful effects are likely to be observed. The dry-weight PECs for cadmium, lead, and zinc are 4.98 mg/kg, 128 mg/kg, and 459 mg/kg, respectively. $\Sigma PEQ_{Cd,Pb,Zn}$ values are a ratio of the sample values in mg/kg dry weight divided by the PEC value for each associated metal. The $\Sigma PEQ_{Cd,Pb,Zn}$ is calculated using the following equation:

$$(Cd/4.98) + (Pb/128) + (Zn/459)$$

In a study of the Tri-State Mining District in the Ozark/Neosho EDU, $\Sigma PEQ_{Cd,Pb,Zn}$ values greater than or equal to 7.92 were considered likely to be toxic to benthic macroinvertebrates (MacDonald et al. 2009).

3.0 Results

3.1 Land Use/Land Cover

Land cover percentages for Crane Creek do not match well to the land cover percentages of the Ozark/White EDU, the Ozark/Neosho EDU, Spring Creek, or Center Creek. Grasslands in particular are easily the dominant type of land cover in Crane Creek. Percent grassland for the Center Creek biological reference reach nearly matches the upstream reaches of Crane Creek; however, these upper reaches are low when compared to the entire Crane Creek watershed or Crane Creek's lower reaches. The Spring Creek biological reference and the Ozark/White EDU appear to have approximately twice the forest cover compared to Crane Creek. The Center Creek biological reference and the Ozark/Neosho EDU appear to have a very large amount of cropland compared to Crane Creek. Although not a perfect match, Turnback Creek in the Ozark/Osage EDU is probably the most similar to Crane Creek overall. It should be noted, however, that land cover percentages given for the Ozark/White and Ozark/Neosho EDUs are

partial datasets; these data do not include land cover outside of Missouri. Land cover percentages are provided in Table 1.

Table 1
Percent Land Use/Land Cover

Land Use/Land Cover	Impervious/ Urban	Barren/ Sparsely Vegetated	Cropland	Grassland	Forest	Woody/ Herbaceous	Wetland	Open Water
Entire Watershed (%)	1.5	0.3	2.4	71.8	19.1	4.8	0.1	0.1
Upstream Crane Cr #0.5 (%)	1.9	0.4	1.0	72.4	19.2	4.9	0.1	0.0
Upstream Crane Cr #1 (%)	1.9	0.4	1.4	70.1	21.7	4.5	0.0	0.0
Upstream Crane Cr #2 & #3 (%)	1.6	0.2	2.6	67.4	24.4	3.7	0.0	0.0
Ozark/White EDU (%)	3.4	1.5	1.3	37.2	48.0	6.0	0.1	2.5
Ozark/Neosho EDU (%)	4.7	0.6	15.2	52.8	20.3	4.8	1.1	0.5
Spring Creek BIOREF (%)	0.6	0.3	0.1	20.4	74.5	3.0	0.1	1.0
Center Creek BIOREF (%)	1.3	0.4	15.7	66.9	12.2	2.8	0.6	0.1
Turnback Creek BIOREF (%)	1.6	0.1	3.3	60.0	29.5	4.7	0.5	0.3

3.2 Stream Habitat Assessment

Habitat assessment scores for the Crane Creek and the Spring Creek biological reference reach are shown in Table 2. Data were collected in September on the two downstream stations of Crane Creek and the Spring Creek biological reference reach, with an additional collection for the most upstream Crane Creek station in October 2013. Mike Irwin and Carl Wakefield performed the scoring. SHAPP guidance states that stations scoring at least 75 percent of the total score of reference/control stations should support a similar biological community. The stream habitat total scores indicated that Crane Creek should support a similar macroinvertebrate community compared to the Spring Creek biological reference stream reach. Habitat parameter categories range from I (optimal) to IV (poor). Habitat parameter scores are listed in parentheses (Table 2) and range from 0 to 20 except for vegetative protection and riparian zone categories, which range from 0 to 10. All Crane Creek total habitat scores were greater than Spring Creek. Crane Creek #0.5 had the highest total habitat score.

Table 2
Category Habitat Scores and Total Habitat Scores from
Stream Habitat Assessments for Crane Creek and the
Spring Creek Biological Reference Stream Reach

Stream Habitat Parameters	Crane Cr #0.5	Crane Cr #1.0	Crane Cr #3.0	Spring Cr
Date	9/23/2013	9/23/2013	10/17/2013	9/26/2013
Epifaunal Substrate/Available Cover	I (16)	III (9)	II (12)	III (9)
Embeddedness	I (18)	I (18)	I (19)	I (17)
Velocity/Depth Regime	I (19)	II (14)	I (17)	I (17)
Sediment Deposition	II (13)	II (13)	III (10)	IV (3)
Channel Flow Status	II (14)	II (12)	II (14)	II (13)
Channel Alteration	I (20)	II (13)	I (20)	I (20)
Riffle Quality	I (16)	III (10)	III (10)	III (10)
Bank Stability – Left Bank	I (10)	I (10)	I (10)	I (9)
Bank Stability – Right Bank	III (5)	I (10)	II (7)	I (10)
Vegetative Protection – Left Bank	II (7)	III (3)	II (7)	IV (1)
Vegetative Protection – Right Bank	IV (1)	III (3)	IV (2)	IV (1)
Riparian Zone Width – Left Bank	I (10)	I (9)	II (7)	I (10)
Riparian Zone Width – Right Bank	I (10)	I (10)	II (7)	I (9)
Total Habitat Score (% of BIOREF)	159 (123)	134 (104)	142 (110)	129 (100)

3.3 Macroinvertebrate Biological Assessment

3.3.1 Semi-quantitative Macroinvertebrate Stream Bioassessment Project Procedure

MSCI scores were calculated at Crane Creek using the perennial/wadeable, riffle/pool, cold water biological criteria for the combined Ozark/White and Ozark/Neosho EDUs. The MSCI scores for the fall 2013 and spring 2014 sampling seasons are shown in Tables 3 and 4. Values shown in bold type are metric scores that are below the fully supporting criteria. A graphic representation of these scores is also given in Figure 4.

All fall 2013 Crane Creek MSCI scores were in the partially supporting category, as were two of the three MSCI scores from spring 2014. The spring 2014 MSCI for station #0.5 was in the fully supporting category, but stations #1 and #3 were in the partially supporting category. Further analysis shows that the fall 2013 biotic index at station #3 was near the scoring threshold and almost achieved an MSCI of 14, but this score would still have resulted in placement in the partially supporting category (Table 3). Similarly, a single EPT taxon at station #0.5 would have resulted in a spring 2014 MSCI score of 18, but this difference would not have resulted in a change in support category (Table 4). More interestingly, in spring 2014 both EPT taxa and biotic index for station #1 were at their respective scoring thresholds. This nearly resulted in the stream attaining a fully-supporting MSCI score of 16, and this would have caused two of the three stations to be placed in the fully supporting category. In reviewing data from fall 1997, an increase of EPT taxa at station #1 would have also increased the MSCI score to 16, placing the reach in the fully supporting category.

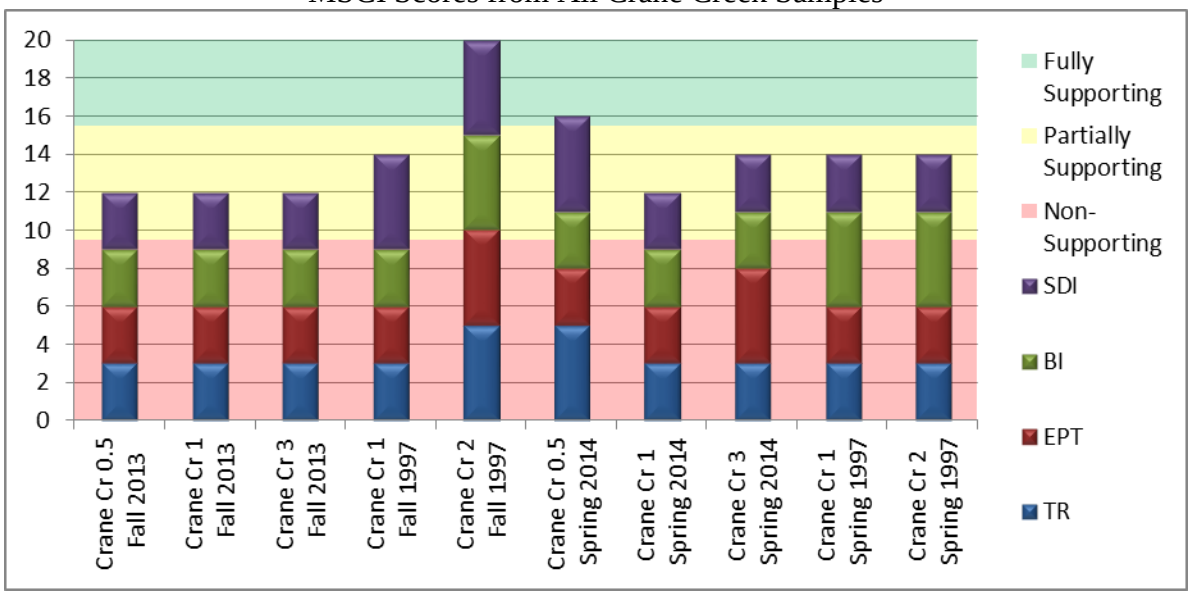
Table 3
Fall Cold Water Biological Criteria for Perennial/Wadeable Streams in the Combined EDUs,
Macroinvertebrate Stream Condition Index (MSCI) Scores,
and Support Categories at Crane Creek

	TR (Score)	EPTT (Score)	BI (Score)	SDI (Score)	Total Score	Support Categories
Fall Riffle/Pool, Cold Water Criteria for Ozark/White EDU						
Score of 5	>80	>23	<5.1	>3.17	--	Fully Supporting
Score of 3	40 - 80	11 - 23	5.1 - 7.5	1.59 - 3.17	--	Partially Supporting
Score of 1	<40	<11	>7.5	<1.59	--	Non-Supporting
Fall 2013						
Crane Cr #0.5	**66 (3)**	**20 (3)**	**5.5 (3)**	**3.11 (3)**	**12**	Partially Supporting
Crane Cr #1	**73 (3)**	**18 (3)**	**5.9 (3)**	**3.05 (3)**	**12**	Partially Supporting
Crane Cr #3	**67 (3)**	**21 (3)**	**5.1 (3)**	**3.07 (3)**	**12**	Partially Supporting
Fall 1997						
Crane Cr #1	**77 (3)**	**23 (3)**	**5.3 (3)**	3.25 (5)	**14**	Partially Supporting
Crane Cr #2	91 (5)	27 (5)	4.8 (5)	3.36 (5)	20	Fully Supporting

Table 4
Spring Cold Water Biological Criteria for Perennial/Wadeable streams in the Combined EDUs,
Macroinvertebrate Stream Condition Index (MSCI) Scores,
and Support Categories at Crane Creek

	TR (Score)	EPTT (Score)	BI (Score)	SDI (Score)	Total Score	Support Categories
Spring Riffle/Pool, Cold Water Criteria for Ozark/White EDU						
Score of 5	>91	>30	<5.2	>3.52	--	Fully Supporting
Score of 3	45 - 91	15 - 30	5.2 - 7.6	1.76 - 3.52	--	Partially Supporting
Score of 1	<45	<15	>7.6	<1.76	--	Non-Supporting
Spring 2014						
Crane Cr #0.5	97 (5)	**30 (3)**	**5.6 (3)**	3.56 (5)	16	Fully Supporting
Crane Cr #1	**86 (3)**	**30 (3)**	**5.2 (3)**	**3.38 (3)**	**12**	Partially Supporting
Crane Cr #3	**87 (3)**	33 (5)	**5.4 (3)**	**3.18 (3)**	**14**	Partially Supporting
Spring 1997						
Crane Cr #1	**82 (3)**	**23 (3)**	4.9 (5)	**3.41 (3)**	**14**	Partially Supporting
Crane Cr #2	**75 (3)**	**26 (3)**	4.7 (5)	**3.37 (3)**	**14**	Partially Supporting

Figure 4
MSCI Scores from All Crane Creek Samples



3.3.2 Analysis of Hypothetical Biological Criteria Data Sets

Even though valid MSCI scores for Crane Creek are generated only by combining data from cold water biological reference stream reaches in the Ozark/Neosho and Ozark/White EDUs, generating criteria and MSCI scores utilizing hypothetical sets of data can provide insight regarding differences that might be due to land cover, EDU, or AES differences. For this study, criteria were also generated for the Ozark/White EDU (Spring Creek only), the Ozark/Neosho EDU (Center Creek only), and the only cold water biological reference stream in the Finley Creek AES type (Turnback Creek). Scoring thresholds for each hypothetical category are given in Table 5.

Table 5
Thresholds to Attain an Optimal Metric Score in Hypothetical Data Sets and the Number of Samples per Set

	Season	TR	EPTT	BI	SDI	n
Ozark/White + Ozark/Neosho	Fall	> 80	> 23	< 5.1	> 3.17	8
Ozark/White only		> 84	> 27	< 5.0	> 3.07	4
Ozark/Neosho only		> 78	> 21	< 5.3	> 3.21	4
Turnback Creek only		> 81	> 27	< 5.1	> 3.31	3
Ozark/White + Ozark/Neosho	Spring	> 91	> 30	< 5.2	> 3.52	8
Ozark/White only		> 100	> 33	< 4.9	> 3.56	5
Ozark/Neosho only		> 89	> 29	< 5.5	> 3.49	3
Turnback Creek only		> 92	> 36	< 5.1	> 3.49	4

Utilizing the scoring thresholds for these hypothetical datasets, MSCI scores can be generated for each of the Crane Creek samples. The resulting scoring combinations are given in Table 6.

Table 6
Metric and MSCI Scores When Using Hypothetical Biological Reference Data Sets

Biological Reference Used	FALL					Spring				
Ozark/White Only	TR	EPTT	BI	SDI	MSCI	TR	EPTT	BI	SDI	MSCI
Station #0.5 2013	3	3	3	5	14	**3**	3	3	**3**	**12**
Station #1 2013	3	3	3	3	12	3	3	3	3	12
Station #3 2013	3	3	3	3	12	3	3	3	3	12
Station #1 1997	3	3	3	5	14	3	3	3	3	12
Station #2 1997	5	3	5	5	18	3	3	5	3	14
Ozark/Neosho Only	TR	EPTT	BI	SDI	MSCI	TR	EPTT	BI	SDI	MSCI
Station #0.5 2013	3	3	3	3	12	5	5	3	5	18
Station #1 2013	3	3	3	3	12	3	**5**	**5**	3	**16**
Station #3 2013	3	3	5	3	14	3	5	**5**	3	**16**
Station #1 1997	3	**5**	3	5	**16**	3	3	5	3	14
Station #2 1997	5	5	5	5	20	3	3	5	3	14
Turnback Creek Only (Same AES)	TR	EPTT	BI	SDI	MSCI	TR	EPTT	BI	SDI	MSCI
Station #0.5 2013	3	3	3	3	12	5	3	3	5	16
Station #1 2013	3	3	3	3	12	3	3	3	3	12
Station #3 2013	3	3	3	3	12	3	3	3	3	12
Station #1 1997	3	3	3	3	12	3	3	5	3	14
Station #2 1997	5	3	5	5	18	3	3	5	3	14

With the exception of the Ozark/Neosho dataset, the results are mostly unremarkable. Several metric values are divergent from the valid scores generated by combining Ozark/Neosho and Ozark/White EDUs. Divergent MSCI scores that would result in a change to the support category are in bold type.

When MSCI scores are generated using only the biological reference stream from the Ozark/White EDU, the only change in support category is Crane Creek #0.5 in spring 2013. When MSCI scores are generated using only the biological reference stream from the Ozark/Neosho EDU, there is a change of support category in three of the 10 Crane Creek samples. Due to the less stringent scoring thresholds when using only the Ozark/Neosho EDU, this is of little surprise. There are no changes in support category when using data from only the Turnback Creek cold water biological reference reach.

3.3.3 Percent EPT and Dominant Macroinvertebrate Families

The percent of EPTT and the five dominant macroinvertebrate families for all Crane Creek samples is presented in Table 7. Values in bold type represent the five dominant macroinvertebrate families and taxa for each station. For comparison purposes, the percent EPT for cold water biological reference streams in the combined Ozark/White and Ozark/Neosho EDU in spring and fall is also provided.

Table 7
Percent EPT and Dominant Macroinvertebrate Families in Crane Creek

Percent EPT taxa												
Season	Fall	Fall 2013			Fall 1997		Spring	Spring 2014			Spring 1997	
Station	BIOREFs	#0.5	#1	#3	#1	#2	BIOREFs	#0.5	#1	#3	#1	#2
% EPT	35.1	27.6	32.1	44.9	41.6	38.6	32.9	31.5	42.0	41.0	35.5	42.3
% Ephemeroptera	25.1	8.8	21.2	29.9	23.5	20.8	23.4	19.6	24.6	31.2	28.4	31.7
% Plecoptera	0.6	1.0	0.4	--	18.0	17.2	4.1	5.6	5.2	5.9	5.6	6.6
% Trichoptera	9.4	17.8	10.5	15.0	0.2	0.6	5.4	6.3	12.1	3.9	1.5	4.1
Percent Dominant Families												
Season	Fall	Fall 2013			Fall 1997		Spring	Spring 2014			Spring 1997	
	BIOREFs	#0.5	#1	#3	#1	#2	BIOREFs	#0.5	#1	#3	#1	#2
Chironomidae	16.6	**25.0**	**15.6**	**12.1**	**17.6**	**16.3**	23.0	**27.2**	**30.8**	**22.2**	**25.6**	**36.1**
Gammaridae	2.0	**16.4**	**23.3**	**18.2**	--	--	5.6	**9.3**	**8.8**	**18.4**	**16.3**	**10.6**
Hydropsychidae	3.0	**16.1**	**9.2**	**10.6**	**12.7**	**12.2**	1.0	3.3	**9.0**	0.5	0.2	0.2
Elmidae	19.7	**11.5**	4.2	5.6	**18.0**	**16.8**	15.3	**6.1**	0.9	**4.8**	2.5	2.1
Baetidae	4.3	**4.1**	6.3	4.6	5.6	2.6	6.9	**10.0**	**7.1**	**5.8**	**7.2**	**15.1**
Heptageniidae	8.2	3.4	**8.3**	5.9	**7.1**	**9.8**	5.8	5.0	6.7	3.6	**6.6**	**6.8**
Arachnida*	2.8	2.9	**7.6**	5.2	2.6	2.1	2.3	3.0	5.2	2.1	1.8	4.1
Leptophlebiidae	2.4	0.5	6.0	**10.7**	4.6	3.6	0.5	3.3	**7.5**	3.0	7.1	0.7
Ephemerellidae	0.6	0.2	0.2	**8.5**	--	--	4.6	1.1	3.0	**18.6**	1.1	**5.0**
Tubificidae	2.6	1.5	0.6	1.5	3.3	3.1	1.2	**9.2**	0.9	2.1	1.2	1.3
Asellidae	0.7	1.9	4.8	<0.1	**8.3**	3.7	3.0	6.0	1.3	1.6	**7.2**	<0.1
Pleuroceridae	8.2	0.8	<0.1	0.6	0.4	**5.8**	6.9	0.5	0.6	0.5	0.9	1.8

* Identified only to class

Although the percent EPT of most Crane Creek samples was similar to the percent EPT of the biological reference streams, it is important to note that the number of EPT taxa in Crane Creek was much lower than the number of EPT taxa in the biological reference streams, resulting in lower MSCI scores. In this case, reviewing data in terms of dominant taxa is more meaningful. Although not specific to EPT taxa, reviewing the top five dominant families does provide some interesting insight. Except for fall 1997, gammarid amphipods are much more abundant in Crane Creek than in the biological reference streams of the combined EDUs, whereas elmid beetles and pleurocerid snails were much less common. Again, broader understanding of these family-level data is gained by reviewing dominant macroinvertebrate taxa.

3.3.4 Dominant Macroinvertebrate Taxa

The top 10 taxa based on dominance in the combined Ozark/Neosho and Ozark/White EDUs and Crane Creek samples are presented in Table 8. When comparing percent macroinvertebrate taxa between Crane Creek samples and the average percentages for the combined EDUs, some trends become evident. With the exception of fall 1997 samples, *Gammarus* abundance is high relative to the average abundance in the combined EDUs. *Cheumatopsyche* abundance is relatively high in all fall samples and in two of the three spring 2014 samples, and *Diphetor* is much more abundant in Crane Creek samples in spring. Percentages of *Optioservus sandersoni* and *Caenis latipennis* are much lower in all spring samples and samples from fall 2013. *Elimia* is found

throughout both EDUs, but the abundance of this taxon appears much lower in Crane Creek samples than the average of the combined EDUs. Although it appears the lack of *Leptoxis* is significant, it is important to note that this taxon has only been found by the MDNR WQMS at Douglas County sites in the North Fork River, Bryant Creek, and Spring Creek.

Table 8
Percent Macroinvertebrate Taxa Ranked by Dominance in the Biological Reference Streams in the Combined EDUs

Percent Dominant Taxa						
Season	Fall	Fall 2013			Fall 1997	
Station	BIOREFs	#0.5	#1	#3	#1	#2
Optioservus sandersoni	15.6	9.8	4.1	5.6	16.7	16.5
Elimia	4.4	0.9	0.1	0.6	0.4	4.4
Caenis latipennis	4.4	0.1	0.3	--	5.8	4.7
Maccaffertium modestum	3.9	2.3	3.8	3.6	5.8	6.3
Leptoxis	3.8	--	--	--	--	--
Chimarra	3.3	1.1	--	2.2	3.6	2.7
Baetis	3.1	1.0	2.3	2.8	3.0	0.6
Hyalella azteca	2.9	--	5.6	7.2	2.0	3.9
Acarina	2.8	2.9	7.6	5.2	2.6	2.1
Dubiraphia	2.7	0.1	0.1	--	1.1	0.3
Cheumatopsyche	2.2	16.0	9.2	8.8	12.2	11.9
Gammarus	2.0	16.4	23.3	18.2	--	--
Season	Spring	Spring 2013			Spring 1997	
Station	BIOREFs	#0.5	#1	#3	#1	#2
Optioservus sandersoni	12.4	5.9	0.9	4.9	2.4	2.1
Cricotopus/Orthocladius	6.4	2.4	4.0	6.8	5.7	3.1
Gammarus	5.6	9.3	8.8	18.4	16.3	10.6
Leptoxis	3.5	--	--	--	--	--
Caenis latipennis	3.5	0.1	0.4	0.1	1.1	0.3
Elimia	3.4	0.6	0.6	0.5	--	1.8
Baetis	2.9	1.5	2.0	1.6	1.5	9.2
Lirceus	2.9	6.0	1.3	1.6	7.2	0.1
Leuctra/Zealeuctra	2.7	4.3	4.0	3.5	1.5	3.8
Acarina	2.4	3.0	5.2	2.1	1.8	0.7
Diphetor	1.4	6.9	4.0	2.1	3.9	4.1
Cheumatopsyche	0.9	3.3	9.0	0.5	0.2	0.2

3.3.5 Biotic Index

Macroinvertebrate taxa that are sensitive to organic pollution were less common in Crane Creek than in the combined EDUs. All samples from fall 2013 and spring 2014 yielded BI scores of 3. In contrast, three out of four 1997 samples resulted in a BI score of 5. The percent of taxa by BI scoring threshold for fall samples is presented in Figure 5, and the percent of taxa by BI scoring threshold for spring samples is presented in Figure 6.

Figure 5
Percent of Taxa by Biotic Index Threshold in Fall Samples

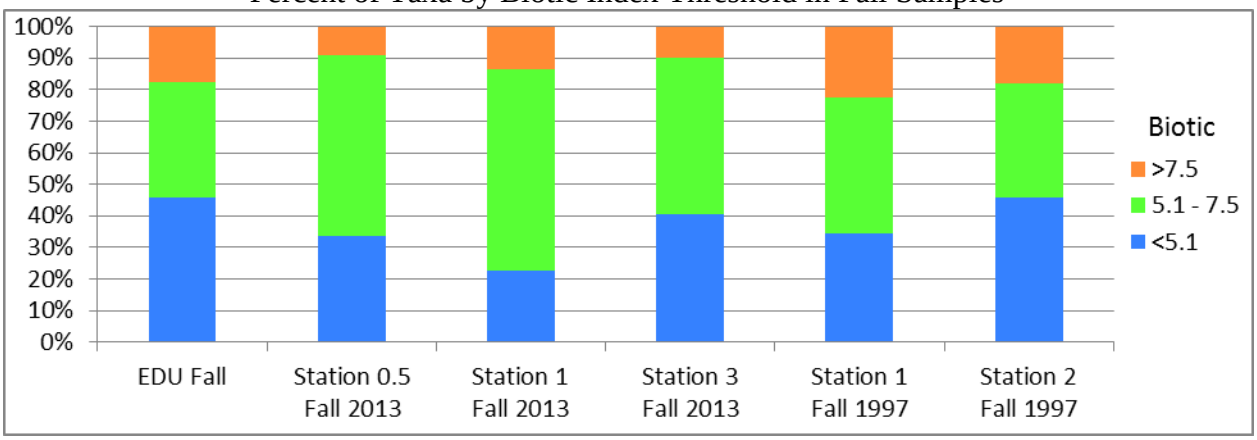
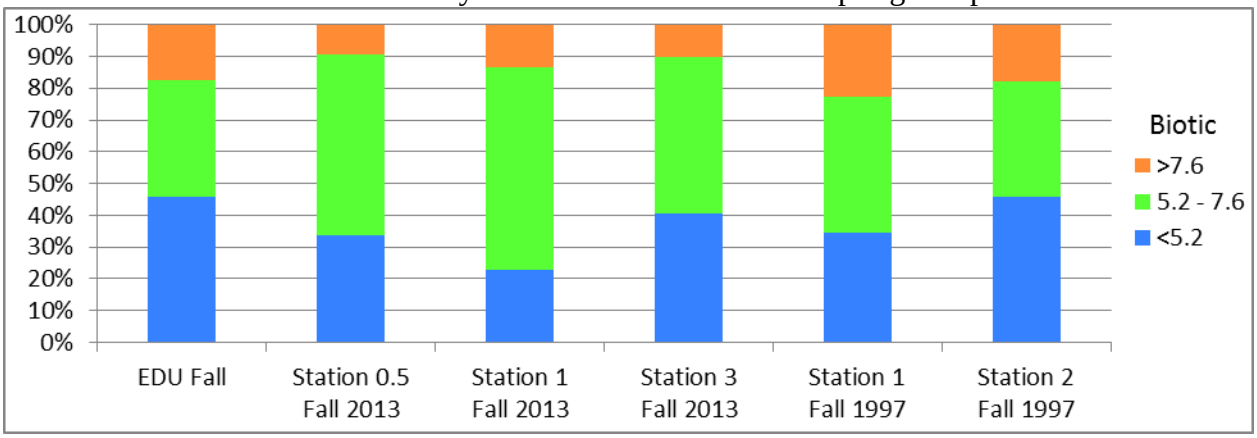


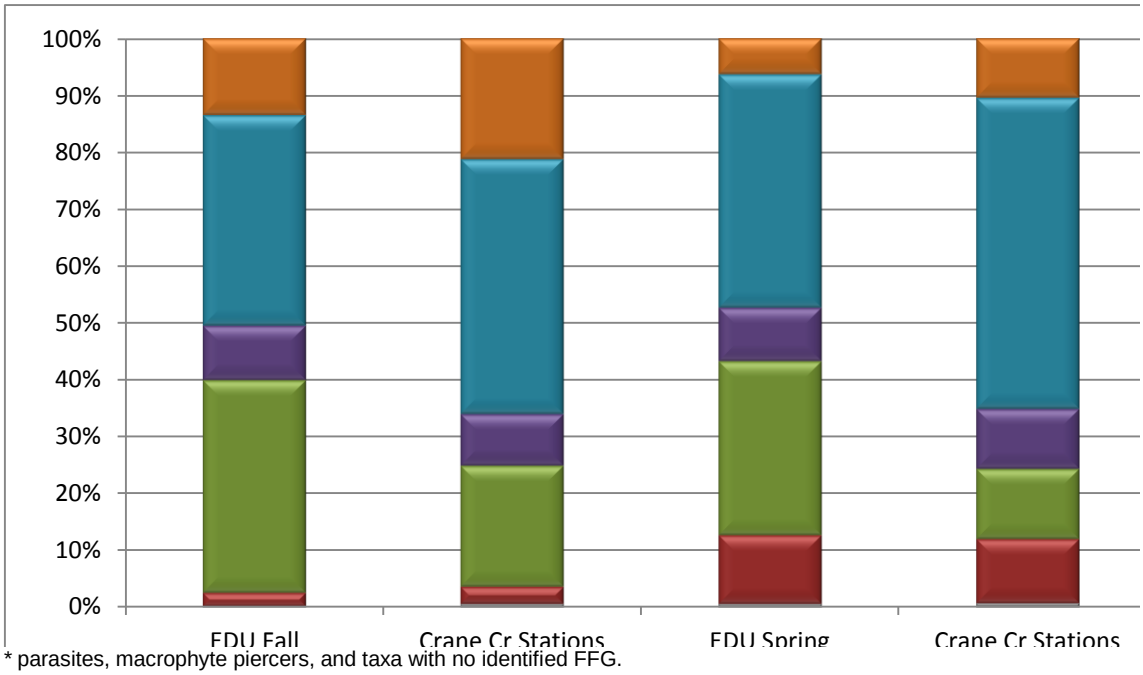
Figure 6
Percent of Taxa by Biotic Index Threshold in Spring Samples



3.3.6 Functional Feeding Groups

Some differences were evident when comparing FFGs of Crane Creek with the FFGs of the combined EDU. Scrapers were less abundant in Crane Creek, and collectors were much more abundant. There was little difference in shredder and predator abundance between Crane Creek and the combined EDU. A comparison of these categories is given in Figure 7.

Figure 7
Percent of Functional Feeding Groups (FFGs)



* parasites, macrophyte piercers, and taxa with no identified FFG.

3.4 Physicochemical Data

3.4.1 Surface Water

Water samples and field measurements were collected during the fall 2013 and spring 2014 macroinvertebrate sampling periods at Crane Creek. Results for physicochemical parameters can be found in Table 9. Parameters were within the applicable limits of Missouri's Water Quality Standards (MDNR 2014a). Except for a detectable level of phosphorus in the most upstream station in fall, nitrogen and phosphorus values are not particularly notable. The specific conductance of station #3 was also slightly elevated in fall.

3.4.2 Fine Sediment

Fine sediment samples were collected once in July 2014. There was a trend of increasing concentration from downstream to upstream, but no metals were above the PEC (MacDonald 2000). The $\Sigma PEQ_{Cd,Pb,Zn}$ was well below the published toxicity threshold (7.92) for the Tri-State Mining District (MacDonald 2009). Results for fine sediment characterization can be found in Table 10.

Table 9
Physicochemical Parameters in Crane Creek Surface Water

Parameter	Fall 2013			Spring 2014		
	Crane Cr #0.5	Crane Cr #1	Crane Cr #3	Crane Cr #0.5	Crane Cr #1	Crane Cr #3
Ca (mg/L)	73.4	67	78.5	59	53	60.9
Mg (mg/L)	3.58	3.27	2.89	2.72	2.44	2.45
NH3-N (mg/L)	<0.03	<0.03	0.099	<0.03	<0.03	<0.03
Chloride (mg/L)	9.12	9.78	8.81	7.08	6.26	6.11
DO (mg/L)	9.07	9.02	10.1	11.58	11.46	12.05
pH (su)	7.6	7.7	--	8.5	8.3	8.1
SC (µS/cm)	342	318	430	326	302	308
Temp (°C)	16.4	16.8	14.2	11	12.1	12.3
Turbidity (NTU)	<1	1.46	<1	1.98	1.38	1.11
Flow (cfs)	31.19	7.68	10	90.2	39.6	24.8
Hardness (mg/L)	198	181	208	159	142	162
NO3+NO2-N (mg/L)	2.92*	2.45*	3.20*	3.49*	2.96*	3.67*
SO4 (mg/L)	5.35	4.59†	4.49†	7.41	7.33	7.84
TN (mg/L)	3.03	2.67	3.32††	2.96	2.63	3.27
TP (mg/L)	<0.01	<0.01	0.02†	<0.01	<0.01	<0.01
NFR (mg/L)	<5**	<5**	<5	<5	<5	<5

* Sample was diluted during analysis
** Exceeded holding time
-- Equipment malfunction
† Estimated value, detected below Practical Quantitation Limits
†† Estimated value, quality control data outside limits

Table 10
Total Metals Character in Crane Creek Fine Sediment

	Crane Cr #0.5	Crane Cr #1	Crane Cr #3	PEC
Cadmium mg/kg	0.420	0.582	3.030	4.98
Lead mg/kg	13.8	19.1	13.7	128
Zinc mg/kg	53.0	78.2	207	459
$\Sigma PEQ_{Cd,Pb,Zn}$	1.2	1.7	4.6	

4.0 Discussion

There is no evidence that habitat or land use/land cover are detrimental to Crane Creek. Unlike the Ozark/White or Ozark/Neosho EDUs, the Crane Creek watershed is dominated by grassland instead of forest. Further analysis would be needed to determine if these grasslands are in fact pasture. However, it is important to note that nitrogen and phosphorus concentrations were not particularly notable. Turnback Creek, a watershed in the neighboring Ozark/Osage but within the same AES type, is more similar in regards to land cover, but Crane Creek MSCI scores are still considered to be suboptimal when compared to Turnback Creek. In addition, habitat assessments suggest that Crane Creek and Spring Creek, both in the Ozark/White EDU, should support a similar biological community.

When applying the criteria for riffle/pool, cold water streams in the combined EDUs, five of the six MSCI scores for Crane Creek were partially supporting in fall 2013 and spring 2014. Crane

Creek MSCI scores fared better when compared only against the Ozark/Neosho EDU, resulting in a hypothetical designation as fully supporting in all spring 2014 samples. Macroinvertebrate MSCI scores were lower, however, when compared only to the Ozark/White EDU. As noted above, Crane Creek fared poorly when comparing it to Turnback Creek. The use of any of these hypothetical criteria sets would not result in any differences in regards to the determination of impairment overall. In short, Crane Creek appears to be partially supporting across multiple comparisons.

The University of Missouri Cooperative Fish and Wildlife Research Unit developed Index of Biological Integrity (**IBI**) scoring criteria to assess streams based on fish communities (Doisy et al. 2008). The Missouri Department of Conservation (**MDC**), the agency that conducts assessments utilizing these criteria, conducted both macroinvertebrate and fish sampling on Crane Creek in 2012 for biological assessment purposes. According to data provided by MDC Stream Ecologist Matt Combes (personal communication, November 17, 2014), macroinvertebrate MSCI scores rated the stream unimpaired approximately 0.75 miles downstream of Crane Creek station #0.5 and partially supporting at Crane Creek station #3. Fish IBI scores rated the stream impaired approximately 0.75 miles downstream of Crane Creek station #0.5 and highly impaired at Crane Creek station #3. Sampling much farther downstream, below a major tributary, showed macroinvertebrate and fish communities to be unimpaired. The MDC findings corroborate the findings of this study.

When comparing percent EPTT along with dominant macroinvertebrate taxa and families, it is very evident that there are community differences between Crane Creek and cold water reference streams in the combined EDUs. Higher Crane Creek BI values suggest that organic pollution is suspect. The reduction of grazers paired with the increase of filtering and gathering collectors is another definite sign that there is a difference in community structure.

There is nothing in the physicochemical data of this study that points to a specific pollutant as a cause of changes in community structure. The wastewater treatment plant for the city of Crane is bracketed by stations #0.5 and #1, but there is no notable change in physicochemical parameters between these two stations. Mineral mines have been shown to have a negative effect on fish metrics even if few mines are present in a watershed (Daniel et al. 2014). Samples for metals in fine sediment yielded an increasing trend in concentration from downstream to upstream, but the most upstream sample was well below PEC. In addition, the mayfly family Heptageniidae is an indicator of metals pollution (Clements et al. 1988, Clements et al. 2000), and these mayflies were abundant in Crane Creek samples. It is important to note, however, that these physicochemical data are not exhaustive. The data set does not include a large number of potential organic and inorganic pollutants.

The reason Crane Creek is not fully supporting of its designated use is beyond the scope of this study. More detailed analysis of land use in the watershed could provide valuable insight. More exhaustive sampling for organic and inorganic pollutants might detect a pollutant. The close proximity of the rail line to Crane Creek cannot be ruled out. Organic and inorganic compounds associated with railways can be a threat to surface waters (Wilkomirski et al. 2011). Although

some dye tracing has been done in the area, it is important to note that there are likely many unknown sinkhole-to-spring conduits that contribute water to Crane Creek. If any significant pollutants are found, pinpointing the source will be a difficult task. Trout populations can also have a profound and cascading effect on macroinvertebrate communities (Simon and Townsend 2003, Whiting et al. 2014), so it is possible that the Crane Creek trout fishery might also be a reason for the observed macroinvertebrate community structure.

5.0 Conclusions

The first null hypothesis stated that land cover characteristics in the Crane Creek watershed will not differ from the land cover characteristics of the Ozark/White EDU, Ozark/Neosho EDU, or biological reference streams in those EDUs. Land cover characteristics were more similar to Turnback Creek in the Ozark/Osage EDU than the Ozark/White EDU, the Ozark/Neosho EDU, and their associated reference streams; therefore, the first null hypothesis is rejected.

The second null hypothesis stated that stream habitat assessment scores in Crane Creek will not differ from Spring Creek, a cold water, riffle/pool biological criteria reference stream in the Ozark/White EDU. All SHAPP scores for Crane Creek were greater than 100 percent in comparison to Spring Creek; therefore, the second null hypothesis is accepted.

The third null hypothesis stated that the macroinvertebrate community in Crane Creek will not differ from the riffle/pool, cold water community for the combined Ozark/White and Ozark/Neosho EDU, the Ozark/White EDU, Ozark/Neosho EDU, or a biological reference stream with the same Aquatic Ecological System (**AES**) type in a neighboring EDU. Crane Creek was determined to be partially supporting for each of these comparisons. The third null hypothesis is rejected.

The fourth null hypothesis stated that physicochemical water quality in the surface water of Crane Creek will meet the Water Quality Standards of Missouri (MDNR 2014a). The fourth hypothesis is accepted.

The fifth null hypothesis stated that total metals in the fine sediment of Crane Creek will not exceed consensus-based guidelines. The fifth null hypothesis is accepted.

Due to low MSCI scores when compared to the combined Ozark/Neosho and Ozark/White EDUs, Crane Creek is partially supporting of its protection of warm water aquatic life designated use. The reason for this reduction in designated use is unknown.

6.0 Recommendations

- Perform a more in-depth land use/land cover analysis to determine if these variables are a possible cause of impairment.

- Sample areas of interface between the stream and railway for a more exhaustive list of organic and inorganic compounds.

- Conduct a comprehensive and quantifiable macroinvertebrate study to determine the effect of trout on the macroinvertebrate community structure in Crane Creek.

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AR:mic

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Cindy Davies, Director, Southwest Regional Office

Appendix A

Crane Creek Macroinvertebrate Taxa Lists

(34 pages)

Aquid Invertebrate Database Bench Sheet Report
Crane Cr [132049], Station #0.5, Sample Date: 9/23/2013 11:45:00 AM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	21	26	4
AMPHIPODA			
Gammarus	147	89	55
Stygobromus	2	2	
BASOMMATOPHORA			
Physella			-99
BRANCHIOBDELLIDA			
Branchiobdellida			1
COLEOPTERA			
Dubiraphia		1	1
Optioservus sandersoni	157	15	2
Stenelmis	23	5	
DECAPODA			
Orconectes neglectus	-99	-99	-99
Orconectes virilis	-99		
DIPTERA			
Ceratopogoninae		4	
Cryptochironomus	1	11	4
Hemerodromia	2		
Micropsectra	17	3	39
Microtendipes		5	12
Parametriocnemus	12	3	3
Paratanytarsus		1	15
Paratendipes		2	
Polypedilum aviceps	71		55
Polypedilum flavum			1
Polypedilum scalaenum grp		2	
Polypedilum tritum			1
Rheocricotopus	3		1
Rheotanytarsus	22	3	42
Simulium	12	1	35
Stempellina		1	
Stempellinella	5	39	10

Aquid Invertebrate Database Bench Sheet Report
Crane Cr [132049], Station #0.5, Sample Date: 9/23/2013 11:45:00 AM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Tanytarsus		4	1
Thienemannimyia grp.	13	3	11
Tipula	1	1	1
Tvetenia bavarica grp	17		5
Tvetenia vitracies	2		
Zavrelimyia		1	2
EPHEMEROPTERA			
Acentrella	18		
Acerpenna	1	1	
Baetis	16		1
Caenis latipennis		1	1
Diphetor	31	1	4
Eurylophella bicolor		2	1
Leptophlebiidae	3	2	4
Leucrocuta	13	3	
Maccaffertium modestum	36	1	3
Stenacron		4	
Stenonema femoratum		1	
Tricorythodes	3	3	2
ISOPODA			
Caecidotea (Blind & Unpigmented)	1		
Lirceus	20	2	11
LUMBRICINA			
Lumbricina	4	2	
LUMBRICULIDA			
Lumbriculidae	3	1	1
MEGALOPTERA			
Nigronia serricornis	6		6
Sialis			1
NEOTAENIOGLOSSA			
Elimia	2	6	7
Hydrobiidae	11	33	1
ODONATA			
Calopteryx			17

Aquid Invertebrate Database Bench Sheet Report
Crane Cr [132049], Station #0.5, Sample Date: 9/23/2013 11:45:00 AM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
PLECOPTERA			
Leuctra	11	4	3
TRICHOPTERA			
Ceratopsyche slossonae	1		
Cheumatopsyche	269	1	14
Chimarra	19		1
Helicopsyche	2	3	
Leptoceridae			1
Polycentropus			3
Pycnopsyche			1
TRICLADIDA			
Planariidae	52	1	8
TUBIFICIDA			
Enchytraeidae		2	
Tubificidae	2	20	4
VENEROIDA			
Pisidiidae			7

Aquid Invertebrate Database Bench Sheet Report
Crane Cr [132050], Station #1, Sample Date: 9/23/2013 1:15:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	15	30	77
AMPHIPODA			
Gammarus	211	88	73
Hyalella azteca			90
BASOMMATOPHORA			
Ancylidae	2	2	
Helisoma			-99
Planorbella		2	
COLEOPTERA			
Dubiraphia			1
Optioservus sandersoni	58	5	2
Psephenus herricki	1		
Scirtidae			1
Stenelmis			1
DECAPODA			
Orconectes neglectus	-99	3	-99
DIPTERA			
Anopheles			1
Brillia		1	
Chironomidae	1	1	3
Cricotopus bicinctus	2		
Cryptochironomus		5	2
Culicidae			2
Dixella			1
Hemerodromia	1		
Heterotrissocladius			1
Micropsectra	4	3	9
Microtendipes	1	38	10
Orthocladius (Symposiocladius)		1	1
Paramerina			4
Parametriocnemus	2		1
Paratanytarsus			1
Paratendipes		2	

Aquid Invertebrate Database Bench Sheet Report
Crane Cr [132050], Station #1, Sample Date: 9/23/2013 1:15:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Polypedilum aviceps	17		1
Polypedilum illinoense grp			1
Polypedilum scalaenum grp		1	
Polypedilum tritum			1
Procladius			1
Rheotanytarsus	23		56
Simulium	26		2
Stempellinella	2	4	10
Stictochironomus		1	
Synorthocladius	2	1	
Tanytarsus	1		
Thienemannimyia grp.	4	2	15
Tipula		1	1
Tvetenia bavarica grp	2		
Zavrelimyia		5	6
EPHEMEROPTERA			
Acentrella	13		
Baetis	34		2
Caenis latipennis	1	2	1
Diphetor	36	1	5
Eurylophella		2	1
Leptophlebiidae	13	53	30
Leucrocuta	30	4	
Maccaffertium modestum	57	1	2
Procloeon		1	8
Stenacron	19	13	
Stenonema femoratum		6	1
Tricorythodes		1	2
ISOPODA			
Lirceus	34	15	28
LUMBRICINA			
Lumbricina	1	2	
LUMBRICULIDA			
Lumbriculidae		5	
MEGALOPTERA			

Aquid Invertebrate Database Bench Sheet Report
Crane Cr [132050], Station #1, Sample Date: 9/23/2013 1:15:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Nigronia serricornis	5		
Sialis	1	12	1
NEOTAENIOGLOSSA			
Elimia	-99	1	
ODONATA			
Hetaerina			2
PLECOPTERA			
Agnetina capitata	-99		
Leuctra	5	2	
TRICHOPTERA			
Cheumatopsyche	144		3
Helicopsyche	4		
Oxyethira		1	1
Polycentropus	2	2	10
TRICLADIDA			
Planariidae	13	2	2
TUBIFICIDA			
Aulodrilus		1	
Limnodrilus hoffmeisteri		1	
Tubificidae		8	
VENEROIDA			
Pisidiidae	1	2	

Aquid Invertebrate Database Bench Sheet Report
Crane Cr [131933], Station #3, Sample Date: 10/17/2013 11:35:00 AM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	24	16	37
AMPHIPODA			
Gammarus	170	28	74
Hyalella azteca			107
BASOMMATOPHORA			
Ancylidae		1	
COLEOPTERA			
Ectopria nervosa		1	
Optioservus sandersoni	71	12	1
DECAPODA			
Orconectes neglectus	-99	-99	-99
DIPTERA			
Ceratopogoninae		2	1
Chironomidae		1	
Corynoneura		1	
Cricotopus/Orthocladius	2	1	
Ephydridae			1
Hemerodromia	1	1	
Micropsectra	3		20
Microtendipes		5	5
Natarsia		1	1
Paramerina		1	3
Parametriocnemus	2		3
Paratanytarsus			1
Polypedilum aviceps	16		5
Polypedilum flavum		1	
Procladius		2	
Rheocricotopus			1
Rheotanytarsus	24		14
Simulium	6		3
Stempellinella	2	30	10
Synorthocladius	5	4	
Thienemanniella			1

Aquid Invertebrate Database Bench Sheet Report
Crane Cr [131933], Station #3, Sample Date: 10/17/2013 11:35:00 AM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Thienemannimyia grp.		1	3
Tipulidae		1	
Tvetenia bavarica grp	8	1	2
EPHEMEROPTERA			
Acentrella	8		1
Acerpenna			1
Baetis	38		4
Diphetor	13		3
Ephemera		3	
Eurylophella	4	89	34
Heptageniidae	12	2	1
Leptophlebiidae	6	48	106
Leucrocuta	3		
Maccaffertium modestum	44	3	6
Stenacron	2	11	
Stenonema femoratum	1	3	
HEMIPTERA			
Belostoma			-99
Notonecta			-99
ISOPODA			
Lirceus			1
LUMBRICINA			
Lumbricina		2	
LUMBRICULIDA			
Lumbriculidae			1
MEGALOPTERA			
Nigronia serricornis	11	-99	-99
Sialis		-99	-99
NEOTAENIOGLOSSA			
Elimia	4	-99	5
Hydrobiidae	5	2	3
ODONATA			
Calopteryx			-99
TRICHOPTERA			
Ceratopsyche	11		3

Aquid Invertebrate Database Bench Sheet Report
Crane Cr [131933], Station #3, Sample Date: 10/17/2013 11:35:00 AM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Cheumatopsyche	110		21
Chimarra	33		
Helicopsyche	14	3	1
Hydropsychidae	11		2
Hydroptila	2		
Leptoceridae		2	2
Polycentropus	1		7
Psychomyia		1	
TRICLADIDA			
Planariidae	9		4
TUBIFICIDA			
Aulodrilus		1	3
Limnodrilus hoffmeisteri			1
Tubificidae		15	3
VENEROIDA			
Pisidiidae		4	10

Aquid Invertebrate Database Bench Sheet Report
Crane Cr [149826], Station #0.5, Sample Date: 3/19/2014 11:35:00 AM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	30	13	7
AMPHIPODA			
Gammarus	97	20	36
Hyalella azteca		18	15
ARHYNCHOBDELLIDA			
Erpobdellidae		-99	
BASOMMATOPHORA			
Physella		2	
Planorbella	1		
BRANCHIOBDELLIDA			
Branchiobdellida			1
COLEOPTERA			
Dubiraphia			3
Optioservus sandersoni	79	2	16
Scirtidae		1	
Stenelmis			1
DECAPODA			
Orconectes neglectus		-99	1
Orconectes virilis			-99
DIPTERA			
Ablabesmyia		1	
Ceratopogoninae	3	17	2
Chaetocladius		1	
Chelifera			3
Chironomidae	4	2	2
Chrysops		1	
Cricotopus/Orthocladius	22	8	10
Cryptochironomus			1
Diamesa	1		
Ephydridae	1		
Eukiefferiella	7		1
Hemerodromia	2		5
Heterotrissocladius		2	

Aquid Invertebrate Database Bench Sheet Report
Crane Cr [149826], Station #0.5, Sample Date: 3/19/2014 11:35:00 AM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Hexatoma			-99
Limnophyes		1	
Micropsectra	1	3	9
Microtendipes		1	5
Nanocladius			3
Ormosia		1	
Orthocladius (Symposiocladius)			1
Parakiefferiella		1	1
Paratanytarsus		2	27
Paratendipes		6	
Polypedilum aviceps	35	5	42
Polypedilum illinoense grp	1		2
Polypedilum scalaenum grp		12	2
Procladius		1	
Rheotanytarsus	19	15	61
Simulium	3		2
Stempellinella	6	19	24
Stenochironomus		1	
Stictochironomus		4	
Sympotthastia	7	5	10
Tanytarsus	1	1	
Thienemannimyia grp.	9	4	35
Tipula	-99		
Tvetenia bavarica grp	1	2	
Zavrelimyia		1	
EPHEMEROPTERA			
Acentrella	17		
Baetis	20		5
Caenis latipennis		1	1
Centroptilum		8	2
Diphetor	93	1	19
Ephemera simulans	1		
Ephemerella invaria	2		2
Eurylophella bicolor	1	1	12
Heptageniidae	26	2	4

Aquid Invertebrate Database Bench Sheet Report
Crane Cr [149826], Station #0.5, Sample Date: 3/19/2014 11:35:00 AM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Leptophlebia		7	11
Leucrocuta	17		
Maccaffertium modestum	27	2	2
Maccaffertium pulchellum	1		
Paraleptophlebia	34		2
Stenacron	1	1	
HEMIPTERA			
Corixidae		1	
ISOPODA			
Lirceus	35	6	58
LUMBRICINA			
Lumbricina		2	
LUMBRICULIDA			
Lumbriculidae		2	3
MEGALOPTERA			
Nigronia serricornis	1		1
Sialis			2
NEOTAENIOGLOSSA			
Elimia	5	3	1
ODONATA			
Gomphidae	1		
Ischnura		2	
PLECOPTERA			
Agnetina capitata	-99		
Amphinemura	6		1
Chloroperlidae	6		
Isoperla	4		5
Leuctridae	52		18
TRICHOPTERA			
Agapetus	3		
Ceratopsyche slossonae		-99	
Cheumatopsyche	40		15
Chimarra	17		1
Helicopsyche	15		
Hydroptila			2

Aquid Invertebrate Database Bench Sheet Report
Crane Cr [149826], Station #0.5, Sample Date: 3/19/2014 11:35:00 AM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Lype diversa			3
Polycentropus			3
Pycnopsyche			-99
Triaenodes		2	2
TRICLADIDA			
Planariidae	12	1	
TUBIFICIDA			
Aulodrilus		2	1
Enchytraeidae		3	1
Ilyodrilus templetoni		1	
Limnodrilus hoffmeisteri		15	2
Tubificidae	7	120	4
VENEROIDA			
Pisidiidae		1	3

Aquid Invertebrate Database Bench Sheet Report
Crane Cr [149827], Station #1, Sample Date: 3/19/2014 12:55:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	51	32	19
AMPHIPODA			
Gammarus	116	37	19
Hyalella azteca		2	101
ARHYNCHOBDELLIDA			
Erpobdellidae		-99	
BASOMMATOPHORA			
Ancylidae		4	
Helisoma			-99
Physella		4	1
Planorbella		2	2
COLEOPTERA			
Optioservus sandersoni	10	8	
Scirtidae			3
DECAPODA			
Orconectes neglectus	-99	-99	-99
Orconectes virilis		-99	-99
DIPTERA			
Ceratopogoninae		2	1
Chelifera	1		1
Cricotopus/Orthocladius	71	2	4
Cryptochironomus		3	
Eukiefferiella	1		
Glyptotendipes	1		
Hemerodromia	3		
Hydrobaenus	1		
Micropsectra	90	2	3
Microtendipes		10	
Orthocladius (Symposiocladius)	1		
Parametriocnemus	1		
Paratanytarsus			19
Paratendipes		3	
Phaenopsectra			1

Aquid Invertebrate Database Bench Sheet Report
Crane Cr [149827], Station #1, Sample Date: 3/19/2014 12:55:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Polypedilum aviceps	26		1
Polypedilum scalaenum grp	6	7	1
Potthastia	1		
Procladius		2	1
Rheotanytarsus	224	2	15
Simulium	2		
Stempellinella	18	13	10
Stenochironomus			1
Stictochironomus		8	
Sympotthastia	1		
Thienemanniella	1		
Thienemannimyia grp.	29	6	9
Tipula	-99		
Tvetenia bavarica grp	1		
Zavrelimyia			5
EPHEMEROPTERA			
Acentrella	18		
Baetis	38		
Caenis latipennis		7	
Centroptilum		4	
Diphetor	69	1	8
Ephemerella invaria	4		
Eurylophella bicolor	3	42	7
Eurylophella enoensis			2
Heptageniidae	26		
Leptophlebia		12	19
Leucrocuta	40		
Maccaffertium modestum	43		2
Paraleptophlebia	113	3	
Stenacron	1	5	
Stenonema femoratum		12	1
HEMIPTERA			
Corixidae	1		
ISOPODA			
Lirceus	16	7	3

Aquid Invertebrate Database Bench Sheet Report
Crane Cr [149827], Station #1, Sample Date: 3/19/2014 12:55:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
LUMBRICINA			
Lumbricina	-99	1	1
LUMBRICULIDA			
Lumbriculidae	1	4	
MEGALOPTERA			
Nigronia serricornis	-99		-99
Sialis	3	1	
NEOTAENIOGLOSSA			
Elimia	3	8	1
ODONATA			
Calopteryx			-99
Gomphidae	1		
Ischnura			1
PLECOPTERA			
Agnetina capitata	2		
Amphinemura	2		
Chloroperlidae	10	1	
Isoperla	10		
Leuctridae	50	25	2
TRICHOPTERA			
Ceratopsyche slossonae			-99
Cheumatopsyche	175		
Chimarra	2		
Helicopsyche	17	2	
Hydroptila	11		2
Ironoquia			-99
Oxyethira	7		5
Polycentropus	6		6
Psychomyia	1		
Pycnopsyche		1	2
TRICLADIDA			
Planariidae	27	3	1
TUBIFICIDA			
Aulodrilus		2	
Tubificidae		14	2

Aquid Invertebrate Database Bench Sheet Report
Crane Cr [149827], Station #1, Sample Date: 3/19/2014 12:55:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
VENEROIDA			
Pisidiidae		9	

Aquid Invertebrate Database Bench Sheet Report
Crane Cr [149828], Station #3, Sample Date: 3/19/2014 2:30:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	7	10	11
AMPHIPODA			
Gammarus	155	42	54
Hyalella azteca		1	26
BASOMMATOPHORA			
Ancylidae	1	10	2
Physella	3	8	6
Planorbella		1	
COLEOPTERA			
Ectopria nervosa		3	
Optioservus sandersoni	34	29	3
DECAPODA			
Orconectes		-99	
Orconectes neglectus	-99		
DIPTERA			
Ceratopogoninae	1	6	
Chelifera			1
Chironomidae		2	
Cricotopus bicinctus			1
Cricotopus trifascia			1
Cricotopus/Orthocladius	64	4	24
Cryptochironomus		1	
Diamesa	1		
Eukiefferiella devonica grp	1		
Hemerodromia		1	
Heterotrissocladius		2	
Micropsectra	11	4	25
Microtendipes		1	
Nanocladius			2
Natarsia		2	1
Orthocladius (Symposiocladius)			1
Paramerina		1	1
Paratanytarsus			1

Aquid Invertebrate Database Bench Sheet Report
Crane Cr [149828], Station #3, Sample Date: 3/19/2014 2:30:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Phaenopsectra		2	
Polypedilum aviceps	7		21
Polypedilum fallax grp		2	
Procladius		2	1
Rheocricotopus	1		2
Rheotanytarsus	5	1	14
Stempellinella	1	28	8
Thienemanniella			2
Thienemannimyia grp.	8	6	32
Tipula	-99		-99
Tvetenia bavarica grp	1		1
Zavrelimyia		5	2
EPHEMEROPTERA			
Acentrella	15		4
Baetis	14	5	3
Caenis latipennis		1	
Centroptilum		2	8
Diphetor	27		1
Ephemera simulans		1	
Eurylophella bicolor	81	94	78
Leptophlebia		20	13
Leucrocuta	24	1	
Maccaffertium modestum	16	1	1
Paraleptophlebia	6	1	1
Stenacron	3	3	
Stenonema femoratum		-99	
Tricorythodes	1		
HEMIPTERA			
Corixidae		1	
ISOPODA			
Lirceus	17	4	1
LUMBRICINA			
Lumbricina		-99	
LUMBRICULIDA			
Lumbriculidae		1	

Aquid Invertebrate Database Bench Sheet Report
Crane Cr [149828], Station #3, Sample Date: 3/19/2014 2:30:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
MEGALOPTERA			
Nigronia serricornis	1		1
Sialis	-99	-99	
NEOTAENIOGLOSSA			
Elimia	1	-99	6
ODONATA			
Calopteryx		-99	1
PLECOPTERA			
Amphinemura	5		8
Chloroperlidae	-99	1	
Clioperla clio			-99
Isoperla	6		2
Leuctridae	15		32
Perlidae	2	9	
TRICHOPTERA			
Cheumatopsyche	3		4
Chimarra	-99		
Helicopsyche	2	1	
Hydroptila	1	1	7
Ironoquia			-99
Lype diversa			1
Nectopsyche		1	
Oecetis			1
Oxyethira	2	1	3
Polycentropus	2		13
Psychomyia		1	2
Pycnopsyche	-99	-99	
Triaenodes	2	2	3
TRICLADIDA			
Planariidae	9		2
TUBIFICIDA			
Aulodrilus		7	
Enchytraeidae		1	
Limnodrilus hoffmeisteri		1	
Tubificidae		21	

Aquid Invertebrate Database Bench Sheet Report
Crane Cr [149828], Station #3, Sample Date: 3/19/2014 2:30:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
VENEROIDA			
Pisidiidae		7	4

Aquid Invertebrate Database Bench Sheet Report
Crane Cr [970214], Station #1, Sample Date: 3/21/1997 8:00:00 AM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	2	11	9
AMPHIPODA			
Gammarus	108	85	8
Hyalella azteca		5	37
Stygobromus	3		
BASOMMATOPHORA			
Helisoma		-99	
Physella		4	1
BRANCHIOBDELLIDA			
Branchiobdellida		1	
COLEOPTERA			
Hydroporus		1	
Optioservus sandersoni	27	2	
Scirtidae			1
Stenelmis	2		
DECAPODA			
Orconectes neglectus	1	-99	1
DIPTERA			
Brillia			2
Ceratopogoninae	2		3
Chrysops		1	
Corynoneura		1	1
Cricotopus/Orthocladius	46	2	22
Diamesa	1		
Dixella			1
Eukiefferiella	22		5
Hexatoma		1	-99
Hydrobaenus	1		
Micropsectra	39	6	44
Nilotanypus		1	
Orthocladius (Symposiocladius)			1
Parakiefferiella		3	
Paramerina			2

Aquid Invertebrate Database Bench Sheet Report
Crane Cr [970214], Station #1, Sample Date: 3/21/1997 8:00:00 AM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Parametriocnemus	2		
Paratanytarsus			5
Paratendipes		7	1
Polypedilum flavum	11		
Polypedilum illinoense grp	1	1	1
Polypedilum scalaenum grp	8	2	
Rheotanytarsus	1		6
Stempellina		1	1
Stempellinella	1	11	4
Sympotthastia			3
Tanytarsus	3	5	3
Thienemanniella	2		9
Thienemannimyia grp.	6	7	4
Tipula	-99		
Tvetenia	6		
Zavrelimyia	1	1	2
EPHEMEROPTERA			
Acentrella	25		1
Baetis	18		1
Caenis latipennis		5	9
Diphetor	46		2
Eurylophella bicolor		4	10
Leptophlebia	2	4	12
Leucrocuta	55	35	4
Maccaffertium modestum	20		1
Paraleptophlebia	68	2	
Procloeon			7
Stenacron	6	7	4
Stenonema femoratum			2
HEMIPTERA			
Corixidae		1	
Microvelia			8
ISOPODA			
Caecidotea	1		
Lirceus	28	35	25

Aquid Invertebrate Database Bench Sheet Report
Crane Cr [970214], Station #1, Sample Date: 3/21/1997 8:00:00 AM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
LUMBRICINA			
Lumbricina	3	1	
LUMBRICULIDA			
Lumbriculidae	7	2	
MEGALOPTERA			
Nigronia serricornis	5		
Sialis	2	-99	
NEOTAENIOGLOSSA			
Elimia	6	2	3
ODONATA			
Calopteryx			1
Stylogomphus albistylus		-99	
PLECOPTERA			
Agnetina capitata	5		
Alloperla	36	6	
Isoperla	3		
Leuctridae	8	9	1
Perlesta	1		
TRICHOPTERA			
Cheumatopsyche	3		
Helicopsyche	1		
Lype diversa			1
Polycentropus	6	2	3
Pycnopsyche		1	
Triaenodes			1
TRICLADIDA			
Planariidae	13		2
TUBIFICIDA			
Aulodrilus			2
Limnodrilus hoffmeisteri		4	1
Tubificidae	1	6	1
VENEROIDA			
Pisidiidae	1	1	

Aquid Invertebrate Database Bench Sheet Report
Crane Cr [970215], Station #2, Sample Date: 3/21/1997 11:00:00 AM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	4	3	1
AMPHIPODA			
Gammarus	79	34	5
Hyalella azteca		1	2
BASOMMATOPHORA			
Ferrissia	1		
Helisoma		-99	
Physella		1	1
COLEOPTERA			
Optioservus sandersoni	22	1	
Paracymus			1
Scirtidae			1
DECAPODA			
Orconectes neglectus	2	-99	-99
DIPTERA			
Antocha	1		
Brillia		1	2
Ceratopogoninae	2	1	
Chrysops	1	-99	
Cricotopus/Orthocladius	4	1	29
Cryptochironomus		1	1
Dixa			1
Eukiefferiella	3		3
Hemerodromia	6		
Hexatoma	2		
Larsia	2	1	
Micropsectra	110	44	1
Microtendipes	1		
Paratanytarsus	1		
Polypedilum flavum	1	2	
Polypedilum scalaenum grp	3	3	
Rheocricotopus			1
Rheotanytarsus		1	21

Aquid Invertebrate Database Bench Sheet Report
Crane Cr [970215], Station #2, Sample Date: 3/21/1997 11:00:00 AM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Stempellinella	10	22	
Sympotthastia			2
Tanytarsus	25	19	1
Thienemanniella	1		21
Thienemannimyia grp.	31	14	8
Tvetenia	2		6
Xylotopus		1	
EPHEMEROPTERA			
Acentrella	5	1	3
Acerpenna	4		5
Baetis	19		83
Caenis latipennis	2	1	
Diphetor	30		15
Ephemera	1	1	
Eurylophella bicolor	7	37	11
Leptophlebia		25	11
Leucrocuta	21	7	2
Maccaffertium modestum	20	4	1
Paraleptophlebia	10		
Procloeon		2	
Stenacron	14	6	
Tricorythodes		3	
HEMIPTERA			
Microvelia			3
ISOPODA			
Lirceus	1		
LUMBRICINA			
Lumbricina		1	
LUMBRICULIDA			
Lumbriculidae		2	
MEGALOPTERA			
Nigronia serricornis	2	-99	1
Sialis	2	1	
NEOTAENIOGLOSSA			
Elimia	17	1	2

Aquid Invertebrate Database Bench Sheet Report
Crane Cr [970215], Station #2, Sample Date: 3/21/1997 11:00:00 AM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
ODONATA			
Calopteryx			5
PLECOPTERA			
Alloperla	1	1	
Clioperla clio			1
Isoperla			25
Leuctridae	26	15	1
Perlidae	3		
TRICHOPTERA			
Cheumatopsyche	1		1
Helicopsyche	13	6	
Hydroptila	1	1	5
Lype diversa		1	
Polycentropus	9	1	1
Pycnopsyche		1	2
Triaenodes			2
TRICLADIDA			
Planariidae	2	3	2
TUBIFICIDA			
Aulodrilus	1		
Enchytraeidae	1		3
Limnodrilus hoffmeisteri	1		
Tubificidae	11	1	
VENEROIDA			
Pisidiidae	2	2	

Aquid Invertebrate Database Bench Sheet Report
Crane Cr [970246], Station #1, Sample Date: 9/17/1997 3:00:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	14	1	19
AMPHIPODA			
Hyalella azteca			26
Stygobromus		5	
ARHYNCHOBDELLIDA			
Erpobdellidae		-99	
BASOMMATOPHORA			
Ferrissia	1	10	
Menetus			2
BRANCHIOBDELLIDA			
Branchiobdellida		1	
COLEOPTERA			
Dubiraphia			14
Optioservus sandersoni	204	8	4
Stenelmis	2		
DECAPODA			
Orconectes macrus	-99		
Orconectes neglectus	2	1	1
Orconectes virilis		1	
DIPTERA			
Ablabesmyia		6	
Anopheles			1
Ceratopogoninae		6	
Chironomus		1	
Corynoneura		2	
Cryptochironomus		3	
Cryptotendipes	1	1	
Dicrotendipes		3	2
Hexatoma	3		
Labrundinia		1	2
Micropsectra	43		1
Microtendipes		7	28
Parakiefferiella			2

Aquid Invertebrate Database Bench Sheet Report
Crane Cr [970246], Station #1, Sample Date: 9/17/1997 3:00:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Parametriocnemus	1		1
Paratanytarsus		2	3
Paratendipes		14	
Polypedilum flavum	4		
Polypedilum illinoense grp			2
Polypedilum scalaenum grp		2	
Rheotanytarsus			7
Simulium	1		
Stempellinella	4	4	8
Tabanus	-99		
Tanytarsus			56
Thienemannimyia grp.	4	2	11
EPHEMEROPTERA			
Acentrella	8		1
Acerpenna	7	2	
Baetis	38		1
Caenis latipennis		49	26
Choroterpes		6	
Diphetor	9	1	
Isonychia bicolor	3		
Leucrocuta	1		
Maccaffertium modestum	64		11
Paraleptophlebia		35	19
Procloeon		1	4
Stenacron		8	
Stenonema femoratum		8	
Tricorythodes		1	
HEMIPTERA			
Microvelia			1
ISOPODA			
Lirceus	9	89	9
LUMBRICINA			
Lumbricina	1	4	
LUMBRICULIDA			
Lumbriculidae	-99	2	

Aquid Invertebrate Database Bench Sheet Report
Crane Cr [970246], Station #1, Sample Date: 9/17/1997 3:00:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
MEGALOPTERA			
Nigronia serricornis	7		3
Sialis		-99	
NEOTAENIOGLOSSA			
Elimia	3	2	
Hydrobiidae			2
ODONATA			
Calopteryx			7
Enallagma			1
Hetaerina			7
PLECOPTERA			
Acroneuria	-99		
Agnetina capitata	2		
TRICHOPTERA			
Ceratopsyche morosa grp	2		
Ceratopsyche slossonae	5		
Cheumatopsyche	155		2
Chimarra	43	3	
Helicopsyche	16		
Polycentropus		1	3
Psychomyia	3		
TRICLADIDA			
Planariidae	4		
TUBIFICIDA			
Enchytraeidae		1	
Limnodrilus hoffmeisteri		3	
Tubificidae	2	36	2
VENEROIDA			
Pisidiidae		2	2

Aquid Invertebrate Database Bench Sheet Report
Crane Cr [970247], Station #2, Sample Date: 9/17/1997 4:30:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	5	9	19
AMPHIPODA			
Crangonyx		1	
Hyalella azteca			62
Stygobromus	1	3	
BASOMMATOPHORA			
Ferrissia		16	2
Menetus			6
Physella		-99	
BRANCHIOBDELLIDA			
Branchiobdellida	1	4	1
COLEOPTERA			
Dubiraphia		1	4
Helichus	1		
Optioservus sandersoni	239	13	11
Scirtidae			1
DECAPODA			
Orconectes macrus	-99		
Orconectes neglectus		2	2
DIPTERA			
Ablabesmyia		2	
Anopheles			7
Brillia		1	1
Ceratopogoninae			1
Chrysops		1	
Corynoneura		1	
Cricotopus/Orthocladius	1		1
Dicrotendipes			1
Dixa			1
Dixella			1
Hexatoma	3		1
Micropsectra	71		36
Microtendipes		13	8

Aquid Invertebrate Database Bench Sheet Report
Crane Cr [970247], Station #2, Sample Date: 9/17/1997 4:30:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Nanocladius	3		
Orthocladius (Symposiocladius)			1
Paramerina		3	9
Parametriocnemus	2		2
Paratanytarsus			5
Paratendipes		6	
Polypedilum flavum	6		3
Polypedilum scalaenum grp		2	
Rheotanytarsus	1		10
Simulium	15		
Stempellina		1	
Stempellinella	16	10	9
Tanytarsus		1	5
Thienemanniella	2	1	2
Thienemannimyia grp.	7	1	8
Tipula		1	
Tvetenia	1		
Xylotopus		1	
Zavrelimyia		6	
EPHEMEROPTERA			
Acentrella	13		
Acerpenna	6		
Baetis	9		
Caenis latipennis		58	16
Choroterpes		1	
Diphetor	11		2
Heptageniidae	20		
Isonychia bicolor	1		
Leucrocuta	11		1
Maccaffertium modestum	100		1
Paraleptophlebia	3	37	17
Procloeon		1	
Stenacron	12		
Stenonema femoratum	11		
Tricorythodes		1	

Aquid Invertebrate Database Bench Sheet Report
Crane Cr [970247], Station #2, Sample Date: 9/17/1997 4:30:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
HEMIPTERA			
Microvelia			1
Rheumatobates			1
ISOPODA			
Caecidotea (Blind & Unpigmented)		5	
Lirceus	8	15	31
LUMBRICINA			
Lumbricina	1	2	
LUMBRICULIDA			
Lumbriculidae	-99	3	
MEGALOPTERA			
Nigronia serricornis	16		4
Sialis		6	1
NEOTAENIOGLOSSA			
Elimia	85	7	1
ODONATA			
Calopteryx			6
Enallagma			1
Hetaerina		2	18
PLECOPTERA			
Acroneuria	3		
Agnetina capitata	2		
Leuctra	3		
Neoperla	1		
TRICHOPTERA			
Agapetus	3		
Ceratopsyche slossonae	5		
Cheumatopsyche	175		15
Chimarra	41		2
Helicopsyche	15	1	
Lype diversa			1
Polycentropus	1		14
Psychomyia			1
TRICLADIDA			

Aquid Invertebrate Database Bench Sheet Report
Crane Cr [970247], Station #2, Sample Date: 9/17/1997 4:30:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Planariidae	5		1
TUBIFICIDA			
Ilyodrilus templetoni		2	
Limnodrilus hoffmeisteri		2	
Quistradrilus multisetosus			1
Tubificidae	1	40	4
VENEROIDA			
Pisidiidae	1	8	4